TITLE: OPERATING PROCEDURE FOR THE OPP-610-PD PULSE DECAY PERMEAMETER/POROSIMETER

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MOC Manager of Industrial Safety: N/A Date: N/A

SNL QA Approval: for wj.green Date: 5/12/95

PURPOSE: This procedure provides instructions for operating the OPP-610-PD Pulse-Decay Permeameter/Porosimeter located in The Two-Phase Flow Laboratory.

RESPONSIBILITY: It is the responsibility of all persons using the OPP-610-PD Pulse-Decay Permeameter/Porosimeter to read and understand this procedure.

SAFETY: The OPP-610-PD operates at pressures up to 20.7 MPA (3000 psi). Operators of this apparatus are required to have received SNL Basic Pressure Safety course PRS 102, the Pressure Worker Training course offered by Albuquerque Valve and Fitting, OPP-610-PD hands-on training from a factory representative or the Principle Investigator or his/her designee, and to have read the ES&H Standard Operating Procedure for this equipment. Safety glasses are required for all occupants of the lab whenever the the OPP-610-PD's door is open or whenever servicing the system. Operators shall also read the Material Safety Data Sheets for helium, nitrogen, vacuum grease, and Syntillo 9951 anti-corrosive agent.

REFERENCES: (latest revision)

I. WIPP Procedure No. 093, Standard Procedure for Core Storage, Requisition, Re-Coring and Shipping

II. WIPP Procedure No. 263, Sample Tracking System

III. WIPP Safety Manual 12-1

IV. Preliminary Hazard Assessment for the OPP-610-PD Pulse Decay Permeameter/Porosimeter

V. ES&H Standard Operating Procedure for the OPP-610-PD Pulse Decay Permeameter/Porosimeter

VI. "Permeability of Granite Under High Pressure," Brace, Walsh & Frangos, 1968, Journal of Geophysical Research

VII. Data Package for the OPP-610-PD Pulse Decay Permeameter/Porosimeter

VIII. Pressure Safety Analysis Report (PSAR) for the OPP-610-PD Pulse Decay Permeameter/Porosimeter

IX. "Pulse Decay Permeability: Analytical Solution and Experimental Test," Bourbie and Walls, SPEJ Forum, 1982

X. Core Test Operator's Manual for the OPP-610-PD; Core Test Inc., 1993

XI. Software Verification Package for the OPP.EXE Program

FORMS: (latest revision)

I. Form 126, Sample Chain of Custody

II. Form 298, Pulse Decay Permeameter/Porosimeter Data

QA RECORDS:

I. Form 126, Sample Chain of Custody

II. Form 298, Pulse Decay Permeameter/Porosimeter Data

III. Data on floppy diskette from the Data Acquisition System's data files (2 copies)

PROCEDURE:

I. **INTRODUCTION**

The OPP-610 Pulse Decay Permeameter-Porosimeter uses an advanced pulse decay technique to measure gas (single-phase) permeability over a range of 10^{-15} to 10^{-21} m^2 (1 millidarcy to 1 nanodarcy). The system also measures gas porosity using a Boyle's Law technique for rocks with porosity ranging from 0.1% to 30.0%. The system can accommodate core "specimens" from 1" to 6" in diameter, 1" to 10" long. Permeability measurements can be made at pore pressures up to 2000 psi. The pore pressure system can use either helium or nitrogen gas. Permeability and porosity can be measured with overburden pressures from 400 to 3000 psi.

This procedure leads the user through the details of test initiation and sample loading followed by a discussion of the auto-run procedure for performing porosity and permeability measurements on core specimens. The user manually performs all test initiation procedures and enters test parameters into the automated test controller software. Based upon the test parameters, the system automatically performs the porosity and/or permeability suite of tests on the loaded specimen. A simplified flowpath of the process, with the appropriate explanatory sections provided, is shown in Figure 1.

The Overburden Core Holder exceeds Sandia's recommended 4:1 safety factor for pressure vessels. However, users of the OPP-610-PD system are required keep a log of pressure cycles over 2400 psi for the Overburden Core Holder in a log book which is kept with the apparatus. Logging is required for future pressure vessel evaluations.

II. TEST INITIATION

Make sure that all cables and connections are correctly hooked up (see section 2.0 of the Operator's Manual, Reference 10), including the test gas(helium or nitrogen), house air, and the power to the system.

A. Turn on the power switch located on the front panel of the OPP-610-PD and the computer power. Turn on the heater switch located above the door. Allow the system to warm up for at least one hour. The loading procedure and test initiation can be carried out while the system is warming up.

B. The control program for the OPP-610-PD is loaded on the hard disk in the OPP directory. To start the program, enter the OPP directory and type OPP1XX (where X is current version number), followed by a [return]. The system will start up the control program and the run screen will appear on the video display. Refer to the software description section of the Operator's Manual (Reference 10) for all of the possible pull-down menu options.

C. Using Form 298, record the date, sample number, footage at test location, specimen number, data file name and the operator's name.

D. Record the pressure transducers' serial numbers and calibration due dates on Form 298.

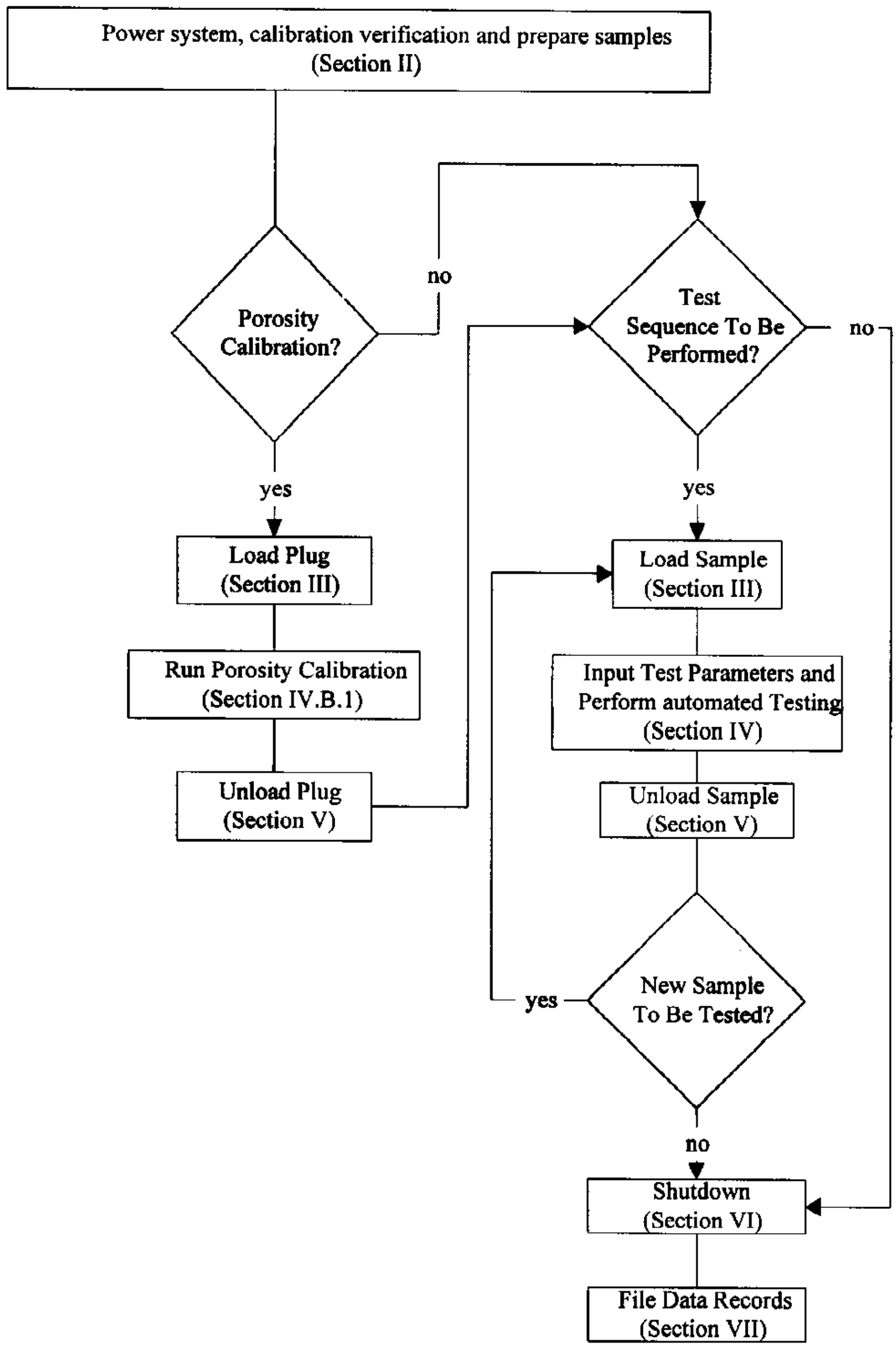


Figure 1. Flowchart

E. Record the weight scale's and caliper's serial numbers. Be sure to calibrate these devices at the time of use for specimen measurements. (Requirement for WIPP QA)

F. Record the flow direction with respect to the in situ bedding plane (check vertical or horizontal) and indicate the test is for linear flow.

G. Measure the sample weight (be sure to do a time of use calibration on the scale before using), and record the weight on Form 298.

H. Measure the specimen length and diameter using a suitable caliper (be sure to do a time of use calibration on the caliper before using). Figure 2 shows a guideline for measurement points on the sample. The diameter shall be measured at three different locations along the axis of the specimen and recorded on Form 298. An average of these three values shall also be entered. The length shall be measured at three different orientations and recorded on Form 298. See Figure 2 for guidelines. Record the average of the three length measurements on the same form.

I. Note any sample peculiarities (such as broken edges or vugs) and the general condition and appearance of the specimen. Enter this information on Form 298 under "Sample Description".

J. Ensure that the printer is on and has paper loaded in it.

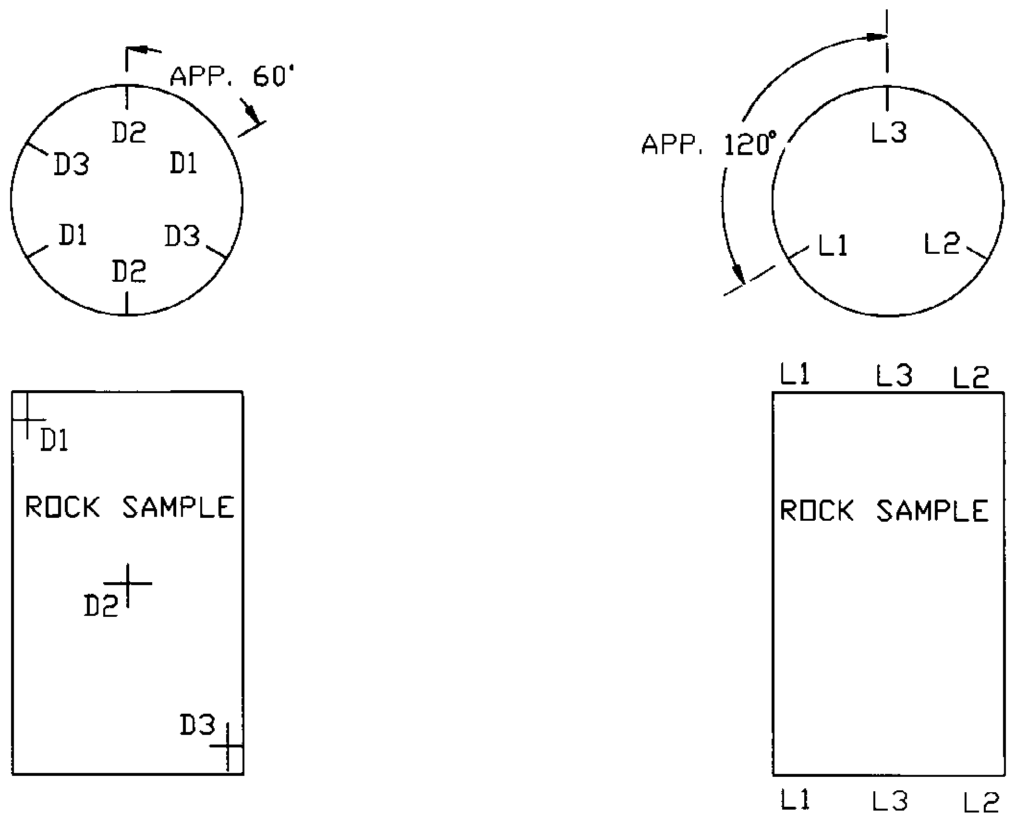
III. SPECIMEN LOADING PROCEDURE

The specimen to be loaded into the system should be clean and free from moisture. It should be a precise right cylinder with flat, parallel ends (runout should be better than 0.002", if possible). The sequence for loading a specimen is described herein. Refer to the plumbing schematic, shown in Figure 3, and drawing of the core holder and photographs of the system in Reference 10 for descriptions of specific parts.

A. Sample Insertion

NOTE: The same sample insertion procedure is followed for porosity or permeability tests as well as performing a porosity calibration. To do a porosity calibration a solid metal plug is substituted for a rock specimen. The calibration run is started from the auto calibrate routine in the auto run pulldown menu.

1. Slide the specimen inside the rubber sleeve. Make sure there is at least 3/4-inch of sleeve extending out from each end of the specimen.



CALIPER CONTACT POINTS
FOR DIAMETER MEASUREMENT

CALIPER CONTACT POINTS
FOR LENGTH MEASUREMENT

Figure 2. Dimension Guide

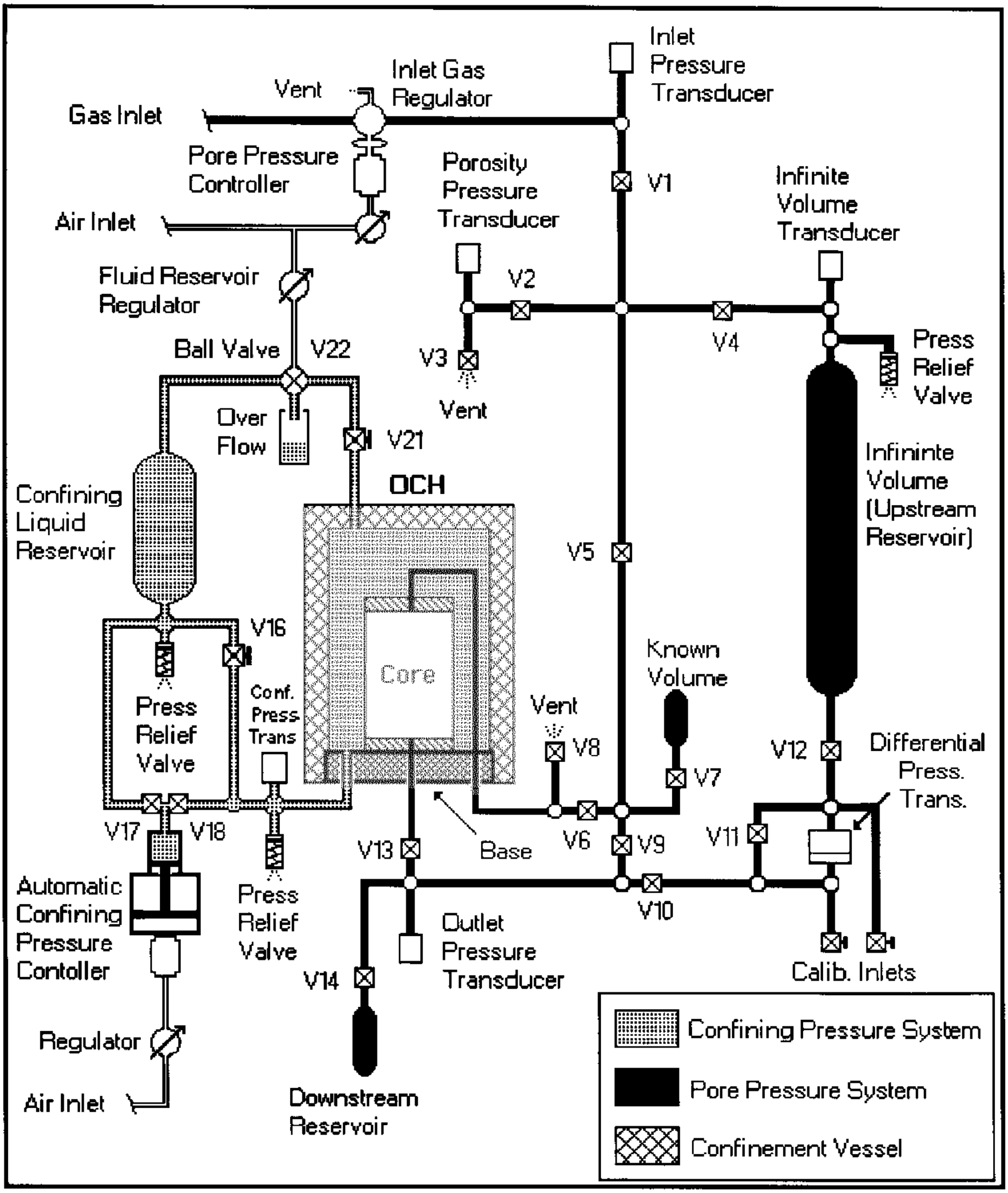


Figure 3. Plumbing Schematic of OPP-610-PD System

2. Lubricate each core holder end plug o-ring with small amount of vacuum grease if necessary.

3. Place a circular piece of screen material, cut to the same diameter as the specimen, inside the sleeve on top of the specimen. (Be sure to use the same pieces of screen that were used for the porosity calibration). Insert the upper end plug into place on top of the screen.

4. Place the other piece of screen inside the lower sleeve end and carefully lower the entire assembly onto the bottom end plug which is attached to the Overburden Core Holder (OCH) base.

5. Place a hose clamp over the sleeve at each end cap where the o-rings sit underneath the sleeve. Position the upper clamp above the o-ring and the lower clamp below the o-ring. Hold the assembly together firmly while tightening the clamps. Attach one end of the small capillary tube to the upper end plug and the other end to the fitting on top of the OCH base plate.

6. To remove any air from the specimen attach the vacuum pump to the vent valve (V8) port at the rear of the machine. Be sure the two pore presssure lines underneath the OCH base plate are connected. Start the pump and open V8,V6,V9 and V13. Turn on the pump and monitor the vacuum gage. If a moderately low level (i.e., the base pressure of the pump) cannot be reached in a few minutes there may be a leak in the system. If there are any leaks in the system, it will be necessary to track down the cause and repair them before proceeding any further. Possible causes for leaks are

   a. the screens may have moved during assembly and are situated between the sleeve and the end cap,

   b. there might be a bad o-ring on either end cap,

   c. the inside of the rubber sleeve may have a bad scratch or groove, or

   d. the fittings on the capillary tube or one of the two pore pressure lines underneath the vessel may be leaking.

7. Run the pump for five minutes after the base pressure of the pump is reached. Close V8 and then shut off the vacuum pump. Be sure to disconnect the vacuum line from the rear of the OPP to allow the system to vent to atmosphere. With the inlet pressure set to zero open V1 to allow some of the test gas fluid to enter the specimen and then close all the valves.

B. Assembly of Overburden Core Holder

1. If the specimen evacuated properly, then the Overburden Core Holder (OCH) can be gently slid back down into place. (It may also be helpful to put a small amount of vacuum grease on the o-ring seal of the OCH.) Pull the OCH vertically downward over the specimen and guide it into place over the base plate.

2. The OCH should slide down completely until it rests on the Teflon slide plate. It may help to push down on the top of the OCH.

3. Rotate the OCH one eigth of a turn to the right (clockwise) and then turn the lock pin until it falls into the notch.

4. Continue to rotate the OCH to the right until the lock pin falls into place. When properly in place, the front handle should line up with the "Closed" label on the mounting plate.

C. Filling the OCH Vessel with Confining Pressure Fluid

The Maximum Allowable Working Pressure (MAWP) for the Overburden Core Holder (OCH)is 3000 psi. The confining fluid system has a pressure relief valve set below the MAWP. This pressure vessel exceeds the recommended minimum safety factor of 4:1. However, in accordance with SNL's Pressure Safety Policy (Reference 8), a service log of confining pressures above 2400 psi (80% of the MAWP) and length of time shall be kept with the OPP-610-PD. It is the operator's responsibility to observe the confining pressures and record this information in the overburden pressure log book.

1. Disconnect the inlet and outlet pore pressure fluid lines underneath the OCH base plate (so that the operator can check for confining fluid leaks after pressurization.) Make sure that the lower and upper manual fill valves are opened (V16 and V21) and set the ball valve (V22) to the "Fill" position.

2. Adjust the air pressure on the fluid reservoir regulator to approximately 20 psi. The confining fluid will now be forced up through V16 into the OCH, displacing the air through V21 on top of the OCH. Carefully observe the plastic line connected to V21. In about three minutes the confining fluid (usually blue-green in color) begins to pass into the plastic line. <u>Quickly</u> close the upper fill valve (V21), else confining fluid will continue flowing into the overflow reservoir.

3. Close valve V16 and back off the fluid regulator to zero psi. The OCH is now isolated and ready for pressurization.

4. Set the confining pressure regulator on the OPP's control panel to approximately 45 psi.

5. Click on the "Manual" Pull-down Menu on the control screen and then open the "Confining Pressure" window. Set the mode button on the ACPC-195 to "FILL". "Purge" and "Fill" the system twice, and set the confining pressure to 500 psi.

6. Make sure the piston position indicator light shows that the ACPC is fully filled. (Left most bar of bargraph is lit.)

7. Set the mode to "Pressurize", the overburden pressure should come up to 500 psi. If not, refer to "Maintenance and Troubleshooting" in Section 5 of the Operator's Manual (Reference 10) for more information.

8. If a leak were to develop between the specimen's rubber sleeve and the endcap during initial pressurization, it should be evident by confining liquid coming out of the pore pressure line fittings underneath the vessel. If a leak occurs dump the confining pressure, drain the fluid and remove the specimen immediately.

9. If no leak is detected, reconnect the two pore pressure lines.

10. Shut the door, turn the fan switch on (located at the top of the temperature control chamber), and wait for the chamber temperature to stabilize. Stability of temperature occurs when the chamber display temperature reaches the chamber set point temperature, and does not vary by more than 0.10 C over a fifteen minute time interval.

11. Bring the pore system regulator up to approximately 90 psi.

IV. AUTOMATED TEST PROCEDURES

In the Automated procedure, the user chooses the desired test or multiple tests to run and enters parameters for each test into the data input screen. The system takes total control and adjusts the confining pressure, pore pressure and wait times for each individual test. The system will automatically perform a Boyle's Law porosity and/or a Pulse Decay permeability test for each test and store the data on the PC's hard disk.

Detailed derivations of how the porosity calibration factor, sample porosity, and sample permeability are calculated within the automated software routines are presented in the Software Verification (Ref.11).

A. Input Data Screens

Once the Auto-test sequence is chosen, the input data screen will appear. The input data screen contains numerous input data fields that can be accessed by clicking the left mouse button on the appropriate box. Listed below are explanations of the information fields found in the input data screen. With the exception of volumes, data must be entered for all fields. A permeability test may be performed without running a porosity test first, but a pore volume from a previous test must be entered. If a porosity test is being performed, no volume input is required as long as the dimensions of the sample are provided. The program will use either the measured bulk volume, the measured grain volume, or the specimen dimensions to calculate the bulk volume, in that order.

FILE NAME: The name of the file under which the input information and the permeability and porosity data are to be stored. This is a DOS type file name so it must be eight characters or less in length, contain no colons, periods or slashes. The input parameters are stored with the same file name with a ".dat" suffix. The test data are stored with a ".por" suffix.

CORE LENGTH: The specimen length in centimeters

CORE DIAMETER: The specimen diameter in centimeters.

PORE VOLUME: In cc's. Calculated in previous porosity test, else it must be included if a permeability test is to be run without a prior porosity test.

GRAIN VOLUME: In cc's. (As long as the specimen length and diameter and bulk volume are input, this data is not necessary.)

BULK VOLUME: In cc's.

NUMBER OF TEST POINTS: This is an integer that sets up the number of pressure points for a suite of tests. At each point either or both permeability and porosity can be measured.

NOTE: For each test point, enter the test pressures and what test(s) (porosity and/or permeability) will be performed.

OVERBURDEN PRESSURE: This is the confining pressure used in the test. This value must be above 400 psi and less than 3000 psi.

PORE PRESSURE: This is the pore pressure for the permeability test. The value must be above 200 psi and less than 2000 psi. (The pore pressure for the porosity test cannot be set by the operator. The porosity test is performed with an initial pore pressure pulse of 200 psi, and then drops to approximately one quarter of the initial pressure.)

POROSITY TEST: This button selects whether the porosity test is to be run. Toggle the button between yes and no by pushing the left button on the mouse.

PERMEABILITY TEST: This selects whether a permeability test is to be run. Toggle the button yes or no with the left mouse button.

PRE-PORO WAIT: This is the wait interval after the confining pressure is applied to the specimen and before the porosity test is to be run, in minutes.

PRE-PERM WAIT: This is the wait interval before the permeability test is to be run, in minutes.

IMPORT FILES: This button allows the operator to import an input data file from the disk, and then rename it or use it for the test.

SAVE FILE: This button allows the operator to save the input data file under a file name which needs to be entered after selecting the save button. The data is stored in the INPUT directory with a ".dat" suffix.

ACCEPT DATA: By activating this button, a window asks the user if the sample has been loaded properly. If the reply is yes then the main screen returns and the software takes control of the sytem.

Once the automatic sequence starts the operator is no longer needed until the tests are completed. A description of the automated porosity and permeability test routines are found in the following pages. During a test, the inlet and outlet pressures, differential pressure, confining pressure and chamber temperature are displayed in the analog data window. In the upper left corner of the screen the status box displays the current step being performed. Once a permeability or porosity measurement is completed the data is stored on the hard disk. After the first test point is complete, the system pauses for the specified wait interval and then proceeds to the next measurement listed in the input data file. At the completion of all test points, the computer displays that the run has completed.

Note: The magnitude of the pressure pulse for the permeability test(s) is configurable from 10 to 25 psi and can be found in the drop down configure menu.

B. Porosity Measurement

The system uses a Boyle's Law method to determine pore volume in the specimen. A calibration factor is used in the calculation of pore volume. To obtain accurate porosity measurements the calibration routine should be run frequently. The main reason for frequent calibration runs is that the calibration factor may change with time due to changes in system temperature. For this reason it is recommended that the system be allowed to warm up and achieve a constant temperature before attempting to perform high accuracy measurements.

1. Porosity Calibration

In the porosity calibration routine the calibration factor is determined by measuring porosity system volumes with a blank stainless steel plug placed between the end plugs. Also recorded and stored on disk during the calibration procedure are the starting (Pfi) and final (Pff) pressure. Two pressure sequences are performed during the porosity calibration run. The first sequence allows the pressure to decay with a known volume linked to the system. In the second sequence, the known volume is not linked during the pressure decay test. After the calibration steel plug is loaded into the system and the auto calibration routine is initiated (from the autorun pulldown menu), the system first sets the confining pressure to approximately 1000 psi, and the pore pressure to 200 psi. Then after the specified wait interval, the test proceeds to the measurement routine. The porosity calibration routine takes less than 5 to 10 minutes to run (not including the sample loading and unloading time). The printer will print out the calibration factors for the run. It is suggested that the calibration test be rerun twice, for a total of three times, to test the repeatability of the calibration measurement.
The calculation of the calibration factor uses the equation:

CALFCT = Known Volume / [(Poi/Pof) - (Pfi/Pff)]

Where Poi and Pof are the initial and final pressures *with* the known volume in line, and Pfi and Pff are the values *without* the known volume in line.

2. Porosity Determination

The porosity measurement is very similar to the calibration procedure except that the pressurizing sequence is only run once. This procedure takes from less than 5 minutes on a high permeability specimen and up to an hour for a low permeability specimen. For large diameter samples, the test time may be even longer. In the porosity measurement sequence the system uses the calibration factor and the start and final pressures for both the calibration run and the test. The pore volume is determined during a test using the following equation:

Pore Volume = CALFCT * [(Pti/Ptf) - (Pfi/Pff)]

Where Pti and Ptf are the initial and final test pressures, respectively, determined for the specimen, and Pfi and Pff are the pressure values determined during the calibration run. The calibration factors are stored on the disk every time they are updated, and are located in a file called CALFCT.DAT.

After calculation of the pore volume, the computer looks at which technique is chosen for the bulk volume and uses the chosen technique to determine porosity according to:

Porosity (%) = (pore volume / bulk volume) * 100%

The computer then stores pertinent information to disk including the point number, pore pressure, net confining pressure, pore volume, bulk volume, and porosity, and temperature. This information is also sent to the printer for hard copy.

C. Permeability Measurement

The OPP-610-PD uses a pulse decay unsteady-state pressure transient technique to measure permeability on specimen from 10^{-15} to 10^{-21} m^2 (1 millidarcy to 1 nanodarcy). Refer to Reference 6 (Brace et al., 1968) and Reference 9 (Bourbie and Walls 1982) for a detailed description of the pulse decay technique. It is important that the specimen porosity be determined prior to a test for the Bourbie-Walls solution to be correct. At the completion of the test, the system returns the valves to their initial positions and proceeds to the next test point. The automatic measurement procedure follows these steps:

1. The system first makes sure that the first overburden pressure is at the proper value.

2. The system will subject the specimen to the desired pore pressure using the internal electronically-controlled regulator.

3. The system isolates the pore pressure line for a short period of time, and monitors the pore pressure.

4. If the pressure is not stable, or if it is out of the desired

range, the system opens the valve to the pore pressure controller again to raise or lower the pore pressure.

5. Once the system has achieved pore pressure stability, the specimen is isolated from the infinite gas reservoir and upstream side of the differential pressure transducer.

6. A pressure pulse is then generated in the upstream reservoir by the electronic regulator.

7. The system isolates the regulator once the pressure pulse reaches the desired setting. The setting is user defineable, an integer from 10 to 25 psi in the Configure menu.

8. The system waits until the pressure pulse stabilizes, this is necessary due to thermal effects.

9. After stabilizing, the data logging is started and the specimen is subjected to the pressure pulse.

10. The system monitors the differential pressure until it decays to the permeability cutoff value specified in the Configure menu.

11. If the pressure decay is too quick, the system sets up to rerun the test with the larger downstream reservoir volume in line. The entire pore pressurization sequence and pressure pulse is repeated with the larger downstream reservoir volume.

12. The system calculates a permeability from the input data and the differential pressure decay data. It takes a few seconds for the system to calculate the permeability. The exponential (Reference 6) and Bourbie-Walls (Reference 9) permeabilities are calculated.After the measurements, the pore and/or overburden pressure is adjusted to the next test point, and the system repeats the entire porosity and/or permeability procedure.

V. SAMPLE UNLOADING PROCEDURE

A. Relieving the OCH Vessel of Confining Pressure Fluid

To remove/relieve pressures within the OCH vessel after a test sequence, these steps should be followed:

1. Vent the specimen's pore pressure to atmosphere by closing valves V4 and V12 (if not already closed), and opening valves V13, V9, V6 and V8.

2. Wait several minutes for the internal pore pressure to escape.

3. After verifying that the mode is set to "Pressurize", drop the overburden pressure to 500 psi using the ACPC-195 control window from the control program.

4. Lower the confining pressure to zero by pressing the "Dump" button. Then "Purge" the ACPC-195. Check the analog display window to ensure that all pressures are atmospheric (zero gage pressure).

5. Turn off the fan switch and open the chamber door. Drain the confining fluid from the OCH using the pneumatic fill/drain system: first open the upper valve (V21), set the ball select valve (V22) to the "empty" position, open the lower valve (V16) and adjust the reservoir air regulator until it reads 20 psi.

6. After hearing a gurgling sound in the lower confining pressure fluid reservoir, decrease the fluid reservoir regulator pressure to zero (turn counter-clockwise).

7. Once the gurgling sound stops, the vessel is drained of fluid and is ready to disassemble.

8. Set the Confining System Regulator and the Pore System Regulator to zero.

B. OCH Vessel Disassembly

The OCH vessel is disassembled as follows:

1. Pull the locking pin on the base plate out and rotate it so that it remains in the retracted position.

2. Grab the two handles on the lower part of the end cap and rotate it to the left (counterclockwise) until the core vessel head is in position with the "open" indicator mounted on the base plate.

3. Gently slide the pressure vessel up. The counterweight will support the weight of the vessel, so it will be relatively easy to lift upward.

4. Dry off any remaining confining pressure fluid using a sponge or towel to mop up excess moisture.

5. Disconnect the small capillary tube at the base plate.

6. Loosen the lower hose clamp and slide the sleeve assembly up and off of the lower end plug.

C. Specimen Removal from Sleeve

The specimen is removed from the sleeve as follows:

1. Remove the pore pressure line fitting from the top end cap.

2. Remove the hose clamps from the top and bottom of the specimen sleeve.

3. If the specimen does not slide out easily, attach a 0.25-28 right hand threaded bolt to the hole in the upper end plug. Pull the end plug out of the sleeve, holding the specimen and sleeve while doing so. Remove the specimen from the sleeve by gently pushing on the specimen.

4. Check the specimen for any confining pressure liquid. If liquid is present note this finding on the data form 298 under the comments section.

5. Store the specimen as per Test Specimen Control Procedures outlined in the appropriate Test Plan.

VI. SHUTDOWN OF SYSTEM

A. If no further tests will be conducted, be sure there is no pressure remaining in the system before turning off the power to the OPP system and computer.

B. Ensure that all of the regulators on the pressure regulator panel are turned all the way counter-clockwise so that a zero pressure indication appears on each regulator gage

C. Turn off and bleed any external supply pressures (i.e., the compressed air supply and the test gas supply).

VII. HANDLING OF DATA RECORDS

1. The operator shall sign and date Form 298. Make two copies of Form 298 and two copies of the printed output. Copy the computer data file onto two 3.5" floppy diskettes.

2. Send the two floppies along with two copies of Form 298 and the printed output to the Principle Investigator for review and forwarding as per WIPP guidelines. Keep one printed copy along with Form 298 in the Salado Two-Phase Flow Scientific Notebook.

VIII. ABNORMAL/EMERGENCY OPERATIONS

A. Procedure for an unexpected power loss during a test.

The OPP system is equipped with an uninterruptable power supply in case of power outages. However, if it should fail in service the OPP's valves will return to their normal position and the test specimen will be isolated from the rest of the pressure system. Care must be taken to avoid having a higher pore pressure inside the specimen sleeve than the confining pressure outside the sleeve. A higher pressure inside the sleeve will result in the sleeve rupturing or an end cap being pushed out of the sleeve allowing the confining fluid to damage the core and also enter the gas fluid lines. These steps must be followed to safely restart the system:

1. Vent any pore pressure inside the specimen by using a 7/16 inch wrench to crack the inlet and outlet pore pressure fittings underneath the confinement vessel. A quarter of a turn should be sufficient to safely bleed off pressure inside the specimen.

2. Reboot the computer(PC), and then start up the OPP **software**

3. Ascertain that the pore pressure is less than the confining pressure in the analog data window.

4. Decide whether to restart the test or remove the specimen to examine it for confining fluid leaks. Note on form 298 why the test was aborted. Be sure to tighten the two fittings if the test is restarted.

B. Procedure for software lockup or system crash.

If the software sytem should stop responding, the pore pressure inside the specimen sleeve should be relieved before rebooting the system. Follow the procedure in part A above for power failure or manually dump the inlet pressure by pressing the red button labeled Inlet Pressure Dump on the control panel. Then manually cycle valves V8, then V13 and V9 together, and then V1 or V6 by pressing the blue buttons on the pilot valves located inside the back wall of the OPP. Repeat this sequence two or three times and then follow steps 2 through 4 in part A above.

REVISION SUMMARY

To be completed by procedure's author before final revision is circulated for signatures.

IX. Revisions made: New Procedure

X. Personnel effected:

(Check appropriate ones)

MOC Craftsman		SNL JOB AREA	
Drilling	___	DAS General	___
Shop	___	DAS B49 Trailer	___
Mechanical	___	DAS Sheds	___
Electrical	___	DAS Equip. Cal. & Inv.	___
Gage	___	Thermocouple	___
Cable/TC	___	Cables	___
U/G DAS	___	Drilling	___
Geotech	___	Gage Installation	___
		Gage Cal. & Removal	___
		Plugging & Sealing	___
		Brine Transport	___
		QA	___
		General	___
		Principal Investigator	___
		Bin Leak Tester	___
		Permeability Testing	✓

Does not Apply to site employees per Robert Nickel 6595 DMiller

XI. Retraining required: (Circle One)

Read/Re-read procedure

Practical demonstration

Other (explain)

Rob Nickel, Org 6115, MS 1324
(per Rob Nickel 6595 DM)

Signature of Procedure's Author Robert Nickel Date 4/26/95